WHAT IS CLAIMED IS:

1. An interconnect structure comprising

at least one conducting metal feature on a substrate, said substrate further comprising an interlayer dielectric layer surrounding said conducting metal feature,

a multilayered dielectric diffusion barrier layer that is a barrier to metal diffusion and is comprised of at least two sublayers where at least one sublayer is an air barrier sublayer which prohibits air permeation and at least another sublayer is a low-k sublayer, and

an interlayer dielectric that is comprised of a line level dielectric and a via level dielectric.

2. The structure of claim 1, wherein the multilayered dielectric diffusion barrier layer has a composite dielectric constant less than 4.0.

3. The structure of claim 1, wherein the air barrier sublayer is a dielectric comprised of a silicon nitride, silicon carbonitride, silicon oxynitride, silicon dioxide, silicon carbide, or fluorinated glass.

4. The structure of claim 1, wherein the air barrier sublayer is a dielectric that has a composition of $Si_vN_wC_xO_yH_z$ where $0.1 \leq v \leq 0.8$, $0 \leq w \leq 0.8$, $0.05 \leq x \leq 0.8$, $0 \leq y \leq 0.3$, $0.05 \leq z \leq 0.8$, and $v+w+x+y+z=1$.

5. The structure of claim 1, wherein the low-k sublayer is a dielectric comprised of $Si_vN_wC_xO_yH_z$ where $0.1 \leq v \leq 0.8$, $0 \leq w \leq 0.8$, $0.05 \leq x \leq 0.8$, $0 \leq y \leq 0.3$, $0.05 \leq z \leq 0.8$, and $v+w+x+y+z=1$.

6. The structure of claim 1, wherein the low-k sublayer contains porosity.

7. The structure of claim 6, wherein the porosity has a closed cell morphology.

8. The structure of claim 1, wherein the multilayered dielectric diffusion barrier layer is a bilayer with the low-k sublayer atop the air barrier sublayer.

9. The structure of claim 1, wherein the multilayered dielectric diffusion barrier layer is a bilayer where the air barrier sublayer atop the low-k sublayer.

10. The structure of claim 1, wherein the multilayered dielectric diffusion barrier layer is a trilayer with the air barrier sublayer placed between two low-k sublayers.

11. The structure of claim 1, wherein the interconnect structure further comprises at least one low dielectric constant material, said low dielectric constant material is comprised of at least one of polysiloxanes, polysilsesquioxanes, polyarylenes, poly(arylene ethers), or a dielectric that is generated by a vapor deposition approach producing a film having the composition $Si_vN_wC_xO_yH_z$ where $0.05 \leq v \leq 0.8$, $0 \leq w \leq 0.9$, $0.05 \leq x \leq 0.8$, $0 \leq y \leq 0.8$, $0.05 \leq z \leq 0.8$ for $v+w+x+y+z=1$.

12. The structure of claim 11, wherein the low dielectric constant material is porous.

13. The structure of claim 1, wherein the via level dielectric is comprised of at least one low dielectric constant material and the multilayered dielectric diffusion barrier layer.

14. The structure of claim 1, wherein the via level dielectric is comprised solely of the multilayered dielectric diffusion barrier layer.

15. The structure of claim 1, wherein the interlayer dielectric is comprised of a line level dielectric of one composition and a via level dielectric having two distinct compositions where the dielectric directly under conducting metal features are of one composition and dielectrics not directly under conducting metal features have the identical composition to the line level dielectric.

16. The structure of claim 1, wherein the conducting metal lines comprise a metal at the top surface that reduces the electromigration characteristics of the interconnect structure.

17. The structure of claim 1, wherein the conducting metal lines comprise a moiety at the top surface that reduces the propensity of the metal lines to oxidize, said moiety is one of benzotriazoles, amines, amides, imides, thioesters, thioethers, ureas, urethanes, nitriles, isocyanates, thiols, sulfones, phosphines, phosphine oxides, phosphonimides, pyridines, imidazoles, imides, oxazoles, benzoxazoles, thiazoles, pyrazoles, triazoles, thiophenes, oxadiazoles, thiazines, thiazoles, quionoxalines, benzimidazoles, oxindoles, or indolines.

18. The structure of claim 1, wherein the line level dielectric comprises a hardmask dielectric that differs in composition from the line level dielectric.

19. The structure of claim 18, wherein the hardmask dielectric comprises a polysiloxane, polysilsesquioxane, or any CVD deposited dielectric having the composition $Si_vN_wC_xO_yH_z$ where $0.05 \leq v \leq 0.8$, $0 \leq w \leq 0.9$, $0.05 \leq x \leq 0.8$, $0 \leq y \leq 0.8$, $0.05 \leq z \leq 0.8$ for $v+w+x+y+z=1$.

20. The structure of claim 1, wherein the line level dielectric and via level dielectric is separated by a dielectric etch stop layer.

21. The structure of claim 20, wherein the dielectric etch stop layer comprises a polysiloxane, polysilsesquioxane, or any CVD deposited dielectric having a composition comprised of $Si_vN_wC_xO_yH_z$ where $0.05 \leq v \leq 0.8$, $0 \leq w \leq 0.9$, $0.05 \leq x \leq 0.8$, $0 \leq y \leq 0.8$, $0.05 \leq z \leq 0.8$ for $v+w+x+y+z=1$.

22. The structure of claim 1, wherein at least one adhesion promoter is present between the multilayered dielectric diffusion barrier layer and dielectric layers above and/or below the multilayered dielectric diffusion barrier layer.

23. The structure of claim 1, wherein at least one adhesion promoter is present between the sublayers of the multilayered dielectric diffusion barrier layer.

24. A method of generating a multilayered dielectric diffusion barrier layer comprising:

applying a coating of a polymeric preceramic precursor by a solvent based approach;

converting the polymeric preceramic precursor into the low-k sublayer; and

applying a coating of an air barrier sublayer.

25. The method of claim 24, wherein the converting of the polymeric preceramic precursor into the low-k sublayer comprises thermal curing, electron irradiation, ion irradiation, irradiation with ultraviolet and/or visible light, or any combination thereof.

26. The method of claim 24, wherein an adhesion promoter is applied prior to the application of the polymeric preceramic precursor.

27. The method of claim 26, wherein the adhesion promoter is codissolved in a solution containing the polymeric preceramic precursor and segregates to film interfaces either during application or during said conversion of the polymeric preceramic precursor into the low-k sublayer.

28. The method of claim 24, wherein an adhesion promoter is applied after the application of the polymeric preceramic precursor and before the said conversion of the polymeric preceramic precursor into the low-k sublayer.

29. The method of claim 24, wherein an adhesion promoter is applied after the said conversion of the polymeric preceramic precursor into the low-k sublayer.

30. The method of claim 24, wherein a sacrificial moiety to produce porosity is codissolved in a solution containing the polymeric preceramic precursor.

31. The method of claim 24, wherein the application of the air barrier sublayer is by chemical vapor deposition processes, plasma enhanced chemical vapor deposition, or physical vapor deposition.

32. The method of claim 24, wherein the air barrier sublayer is annealed by thermal curing, electron irradiation, ion irradiation, irradiation with ultraviolet and/or visible light, or any combination thereof.

33. The method of claim 24, wherein an adhesion promoter is applied to the air barrier sublayer to enhance adhesion to other layers.

34. The method of claim 24, wherein the air barrier sublayer is exposed to a reactive plasma to modify the surface of the air barrier sublayer in order to enhance adhesion to other layers.

35. The method of claim 24, wherein the low-k sublayer is exposed to a reactive plasma to modify the surface of the low-k sublayer in order to enhance adhesion to other layers.

36. A composition for the generation of a multilayered dielectric diffusion barrier layer comprising:

a solvent for application of the low-k sublayer by a solvent based approach;
a polymeric preceramic precursor that is converted to a low-k sublayer; and
an air barrier sublayer.

37. The composition of claim 36, wherein the polymeric preceramic precursor comprises polysilazanes, polycarbosilanes, polysilasilazanes, polysilanes, polysilacarbosilanes, polysiloxazanes, polycarbosilazanes, polysilylcarbodiimides, polysilsesquiazanes or polysilacarbosilazanes.

38. The composition of claim 36, wherein the polymeric preceramic precursor includes pendant functional groups bonded to the chain backbone, said pendent function groups are selected from the group consisting of amines, amides, imides,

thioesters, thioethers, ureas, urethanes, nitriles, isocyanates, thiols, sulfones, phosphines, phosphine oxides, phosphonimides, benzotriazoles, pyridines, imidazoles, imides, oxazoles, benzoxazoles, thiazoles, pyrazoles, triazoles, thiophenes, oxadiazoles, thiazines, thiazoles, quionoxalines, benzimidazoles, oxindoles, indolines, hydride, vinyl, allyl, alkoxy, silyl and alkyl.

39. The composition of claim 36, wherein the polymeric preceramic precursor has a composition of $Si_vN_wC_xO_yH_z$ where $0.1 \leq v \leq 0.8$, $0 \leq w \leq 0.8$, $0.05 \leq x \leq 0.8$, $0 \leq y \leq 0.3$, $0.05 \leq z \leq 0.8$, and $v+w+x+y+z=1$.

40. The composition of claim 36, wherein an antistriation agent is codissolved in the solution containing the polymeric preceramic precursor to produce films of high uniformity.

41. The composition of claim 36, wherein an adhesion promoter is codissolved in the solution containing the polymeric preceramic precursor.

42. The composition of claim 36, wherein a sacrificial moiety to produce porosity is codissolved in the solution containing the polymeric preceramic precursor.

43. The composition of claim 36, wherein the low-k sublayer has a composition of $Si_vN_wC_xO_yH_z$ where $0.1 \leq v \leq 0.8$, $0 \leq w \leq 0.8$, $0.05 \leq x \leq 0.8$, $0 \leq y \leq 0.3$, $0.05 \leq z \leq 0.8$ for $v+w+x+y+z=1$.